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(71) Applicant: **LINDE AKTIENGESELLSCHAFT**
[DE/DE]; Klosterhofstrasse 1, 80331 Munich (DE).

(72) **Inventors:** **CANNER, Philip**; 513/6 Acacia Place, Abbotsford, Victoria 3067 (AU). **HARRIS, David**; 41 Butt Lane, Milton, Cambridge Cambridgeshire CB24 6DG (GB). **WICKS, Ben**; 5 Garden Court, Histon, Cambridge Cambridgeshire CB24 9JN (GB).

(74) **Agent:** **CHRISTIE, Gemma**; The Priestley Centre, 10 Priestley Road, Surrey Research Park, Guildford Surrey GU2 7XY (GB).

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(54) Title: A DEVICE FOR ATOMISING A LIQUID

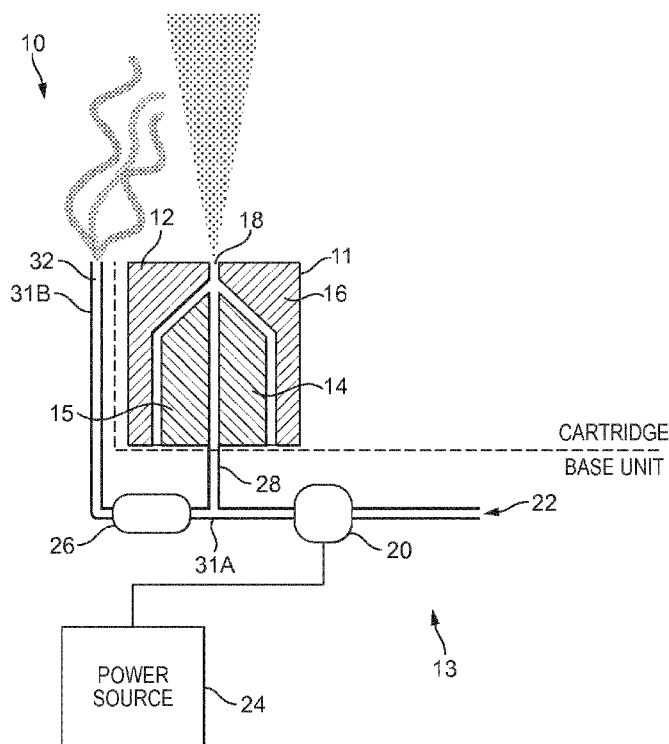


FIG. 1

(57) **Abstract:** A device (10) for atomising a liquid comprising a housing (12) having a reservoir (16) of liquid connected to an atomising nozzle (14) and an outlet (18). A compressor (20) connectable to a gas source (22), and fluidly connected to the housing (12) by a first channel (28), is also located within the housing (12) along with a power source (24) for the compressor and an oxygen concentrator (26) comprising a second channel (31A, 31B). The device supplies pressurised gas from the compressor through the first channel into the housing and onto the atomising nozzle to atomise the liquid in the reservoir to dispense it from the outlet as an aerosol plume. The device is arranged so that the oxygen concentrator supplies an oxygen containing gas through the second channel to boost the oxygen content in the aerosol plume.



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SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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- 1 -

A DEVICE FOR ATOMISING A LIQUID**BACKGROUND OF THE INVENTION**

5 The present invention relates to a device for atomising a liquid.

 Atomised liquids are used for many purposes. One such use is for therapy, for example, by application to the skin or by inhalation. One example is the atomisation of sodium
10 chloride for inhalation to assist with the removal of mucus and debris from the lungs. Another example is atomisation of hyaluronic acid for skin beauty purposes.

15 An exemplary device for atomising liquids to form a mist is the PARI TurboBoy® SX. The device uses a compressor to supply compressed air into a housing containing an atomiser and atomisable liquid. A mouthpiece/face mask is attached to an outlet port on the device through which a user inhales
20 the atomised liquid.

SUMMARY OF THE INVENTION

 According to the present invention there is provided a
25 device for atomising a liquid, the device comprising: a housing comprising a reservoir of liquid fluidly connected to an atomising nozzle and an outlet; a compressor connectable to a gas source and fluidly connected to the housing by a first channel; a power source for the
30 compressor; and an oxygen concentrator comprising a second channel; wherein the device is arranged to supply pressurised gas from the compressor through the first

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channel into the housing and onto the atomising nozzle to atomise the liquid in the reservoir to dispense it from the outlet as an aerosol plume; and wherein the device is further arranged such that the oxygen concentrator supplies an oxygen containing gas through the second channel to boost the oxygen content in the dispensed aerosol plume. The present invention thus provides a simple device for creating an oxygen enriched aerosol.

10 The device may be arranged such that the second channel fluidly connects the oxygen concentrator into at least one of a position upstream of the nozzle, and the aerosol plume.

15 The device may be arranged such that the second channel fluidly connects the oxygen concentrator to the position upstream of the nozzle, wherein the device is then arranged such that the oxygen concentrator supplies an oxygen containing gas through the second channel only into the position upstream of the nozzle.

20 Alternatively, the device may be arranged such that the second channel fluidly connects the oxygen concentrator to a second outlet in fluid communication with the aerosol plume, and wherein the device is then arranged such that the oxygen concentrator supplies an oxygen containing gas through the second channel only into the aerosol plume.

30 In this case, the outside of the housing may be inwardly tapered towards the outlet, and the downstream end of the second channel may terminate in an opening which extends around the outside of the housing, wherein oxygen containing gas from the opening is arranged to be supplied towards the

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outlet. In this way, the oxygen containing gas from the opening can pass along the outer surface of the housing toward the aerosol plume, by way of the Coanda effect.

5 Alternatively, the oxygen concentrator may supply an oxygen containing gas into both the position upstream of the nozzle and the aerosol plume by comprising a further channel to the second channel, wherein the second channel fluidly connects the oxygen concentrator to the position upstream of
10 the nozzle, and the further channel fluidly connects the oxygen concentrator to the second outlet in fluid communication with the aerosol plume.

 Preferably the power source is a battery.
15

 The device is preferably arranged to generate an aerosol plume which comprises droplets of a diameter of less than 10µm.

20 The liquid inside the reservoir may be a saline solution, for example a solution of sodium chloride. In this way, the device is then useable to assist with the removal of mucus and debris from the lungs. The liquid may instead contain hyaluronic acid so that the device can be used for
25 skin beauty purposes.

 The device may further comprise a liquid inlet in fluid communication with the reservoir to allow the liquid in the reservoir to be refilled.

30

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The pressurised gas is preferably a breathing gas such as compressed air or helium (a mixture of helium and oxygen).

5 The housing may be supplied as part of a single-use disposable cartridge. In which case, the compressor and the oxygen concentrator may be housed in a base unit for receiving the cartridge.

10 In this case, the base unit may be connectable to the cartridge by a screw thread to securely connect the two components together.

15 The downstream end of the first channel may comprise a perforating means, and the cartridge may then comprise a perforable film that is upstream of the atomising nozzle and that can be perforated by the perforating means. This ensures that the cartridge is sealed prior to use.

20 **BRIEF DESCRIPTION OF THE FIGURES**

The invention will now be described with reference to the accompanying Figures in which:

25 Figure 1 shows a cross section view of an atomiser device according to the invention.

Figure 2A shows a side view of a cartridge and base unit from an atomiser device according to the present invention.
30 Figure 2B shows a cross section view of the atomiser device shown in Figure 2A when taken through section A-A. Figure 2C

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shows a perspective view of the device from Figure 2A with the cartridge detached from the base unit.

Figure 3A shows a side view of another cartridge and base unit from a different atomiser device according to the present invention. Figure 3B shows a cross section view of the atomiser device shown in Figure 3A when taken through section B-B.

DETAILED DESCRIPTION

With reference to Figure 1, there is shown an atomiser device 10 which comprises a cartridge 11 defining a generally cylindrical housing 12 within which is located a reservoir 16 of atomisable liquid, and an atomising nozzle 14.

Extending from an outer edge of the housing 12 is an access channel 15 for allowing gas from outside of the cartridge 11 to enter the atomising nozzle 14.

An opening 18 is present on the housing 12 which is fluidly connected to the liquid contained in the reservoir 16 to define an outlet for the liquid from the cartridge 11. A closure means (not shown), such as a valve or a peelable film, is located between the reservoir 16 and the opening 18 to control the flow of liquid through the opening 18 when the device is not in use.

The cartridge 11 is supported in use by a base unit 13 which includes a compressor 20 connected to a supply 22 of

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air or other breathable gas. The compressor is powered by a power source 24, for instance a battery.

A gas channel 28 in the base unit 13 extends from the compressor 20 and is fluidly connectable with the access channel 15 of any cartridge 11 connected to the base unit 13. The gas channel 28 thus allows compressed gas from the compressor 20 to enter the atomising nozzle 14 of any connected cartridge 11.

An oxygen concentrator 26 containing an oxygen enriched gas is also located in the base unit 13. The oxygen concentrator 26 is selectively connectable by a valve arrangement to one/both of two channels 31A;31B. The first channel 31A is fluidly connected to the gas channel 28 in the base unit to allow oxygen enriched gas from the concentrator 26 to pass into the access channel 15 of any cartridge 11 connected to the base unit 13. The second channel 31B extends from the concentrator 26 to a vent 32 located in the vicinity of the opening 18 of a cartridge 11 connected to the base unit 13.

In use of the device 10, a cartridge 11 is connected to the base unit 13 so that the gas channel 28 of the base unit 13 fluidly connects with the access channel 15 of the cartridge 11. The base unit 13 is then operated such that the compressor 20 supplies gas into the atomising nozzle 14 of the cartridge 11 to atomise the liquid contained in the reservoir 16 such that the liquid forces open, and passes through, the closure means into the opening 18 and out of the device 10 as an aerosol spray/plume with droplets having a diameter of less than 10µm.

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Depending on which of the channels 31A;31B the oxygen concentrator is connected to, during the atomisation of the liquid in the reservoir 16, oxygen enriched gas is supplied into the gas channel 28 via channel 31A, and/or is supplied
5 into the generated aerosol plume via channel 31B. In either operation however, an oxygen enriched aerosol plume is generated by the device 10.

10 Another atomiser device 10' according to the present invention is shown in Figures 2A-2C. The structure and operation of device 10' is largely similar to the device 10 shown in Figure 1.

15 As shown best with reference to Figure 2B, the device 10' comprises a base unit 13 connectable to a removable cartridge 11 via a screw thread 17.

The access channel 15 from the cartridge 11 is
20 connectable to the gas channel 28 from the base unit 13. The tip of the gas channel 28 is pointed to define a puncturing means 29 which is operable to pierce a film (not shown) located over the access channel 15 from the cartridge 11 when it is first connected to the base unit 13.

25

In the device 10', oxygen from the oxygen concentrator 26 is supplied into the generated aerosol plume via channel 31B. The vent 32 from this channel 31B defines a circumferential opening which extends around a portion of
30 the cartridge 11. Because of the circumferential shape of the vent 32, and the outside surface of the cartridge being inwardly tapered towards the opening, oxygen emitted from

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the vent 32 is forced along the outer surface of the cartridge 11 towards the aerosol plume emitted from the opening 18. This effect of the oxygen being forced along the outer surface of the cartridge 11 is known as the Coanda effect. With this configuration, the length of the generated aerosol plume from the opening 18 is increased.

A further atomiser device 10'' according to the present invention is shown in Figures 3A-3B. The structure and operation of device 10'' is very similar to the device 10 shown in Figures 2A-2C. The cartridge 11 in this embodiment however is fixed to the base unit 13, and also comprises an inlet 34 fluidly connected to the reservoir 16 for topping up the liquid contained therein.

15

The liquid contained within the reservoir is any liquid which can be atomised. Exemplary liquids which can be used include a solution of sodium chloride for when the device is used assisting with the removal of mucus and debris from the lungs, and hyaluronic acid for use in skin beauty purposes.

20

CLAIMS

1. A device for atomising a liquid, the device comprising:
a housing comprising a reservoir of liquid fluidly
5 connected to an atomising nozzle and an outlet;
a compressor connectable to a gas source and fluidly
connected to the housing by a first channel;
a power source for the compressor; and
an oxygen concentrator comprising a second channel;
10 wherein the device is arranged to supply pressurised
gas from the compressor through the first channel into the
housing and onto the atomising nozzle to atomise the liquid
in the reservoir to dispense it from the outlet as an
aerosol plume; and
15 wherein the device is further arranged such that the
oxygen concentrator supplies an oxygen containing gas
through the second channel to boost the oxygen content in
the dispensed aerosol plume.
- 20 2. A device according to claim 1 wherein the oxygen
concentrator supplies the oxygen containing gas into at
least one of a position upstream of the nozzle and the
aerosol plume.
- 25 3. A device according to claim 2, wherein the second
channel fluidly connects the oxygen concentrator to the
position upstream of the nozzle, and wherein the device is
arranged such that the oxygen concentrator supplies an
oxygen containing gas through the second channel only into
30 the position upstream of the nozzle.

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4. A device according to claim 2, wherein the second channel fluidly connects the oxygen concentrator to a second outlet in fluid communication with the aerosol plume, and wherein the device is arranged such that the oxygen
5 concentrator supplies an oxygen containing gas through the second channel only into the aerosol plume.

5. A device according to claim 4 wherein the outside of the housing is inwardly tapered towards the outlet, and
10 wherein the downstream end of the second channel terminates in an opening which extends around the outside of the housing, wherein oxygen containing gas from the opening is arranged to be supplied towards the outlet.

15 6. A device according to any preceding claim wherein the power source is a battery.

7. A device according to any preceding claim wherein the device is arranged to generate an aerosol plume which
20 comprises droplets of a diameter of less than 10µm.

8. A device according to any preceding claim wherein the liquid inside the reservoir is a saline solution.

25 9. A device according to any preceding claim further comprising a liquid inlet in fluid communication with the reservoir.

10. A device according to claims 1-8 wherein the housing is
30 supplied as part of a single-use disposable cartridge.

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11. A device according to claim 10, wherein the compressor and the oxygen concentrator are housed in a base unit for receiving the cartridge.

5 12. A device according to claim 11, wherein the base unit is connectable to the cartridge by a screw thread.

13. A device according to claims 10-12, wherein the downstream end of the first channel comprises a perforating means, and the cartridge comprises a perforable film that is
10 upstream of the atomising nozzle and that can be perforated by the perforating means.

14. A device as substantially hereinbefore described with
15 reference to the accompanying drawings.

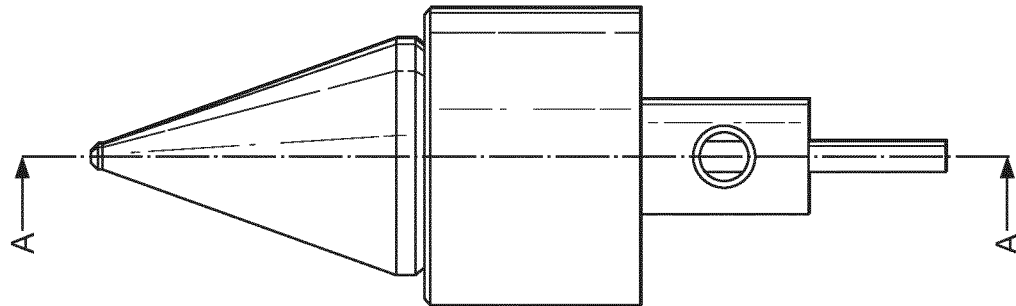


FIG. 2A

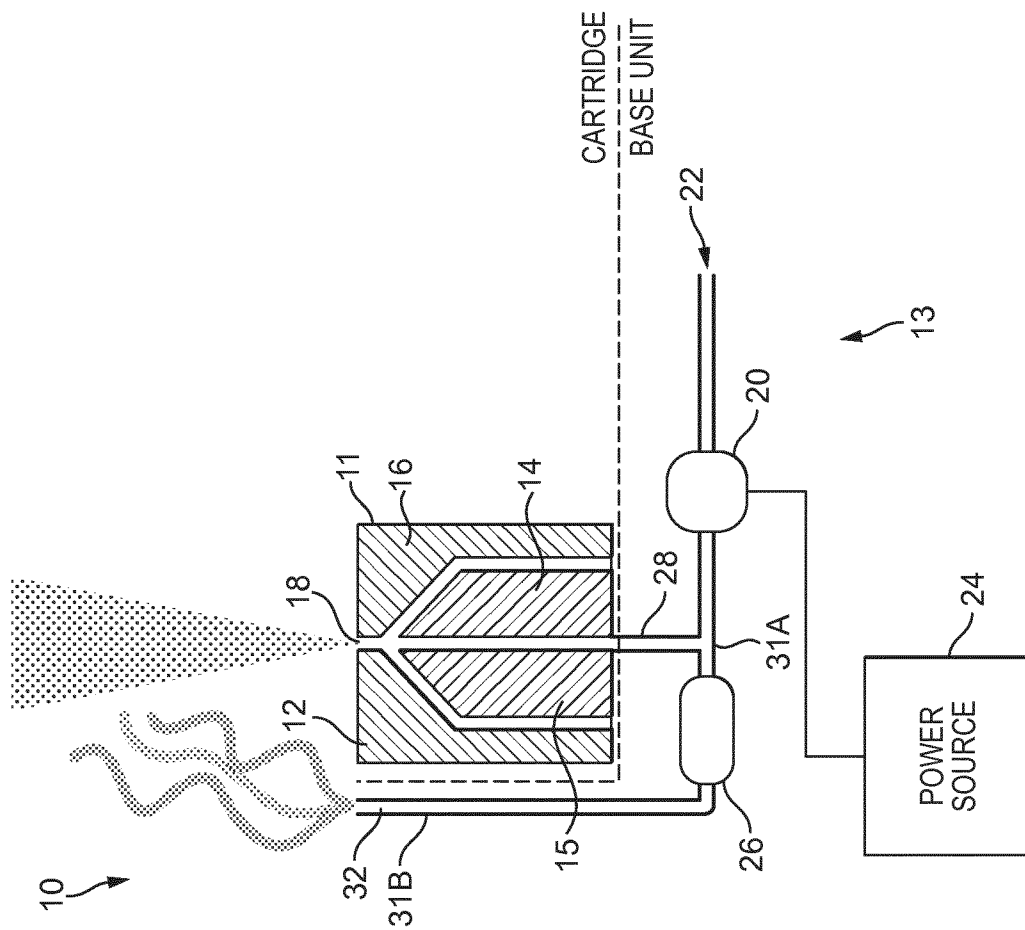


Fig. 1

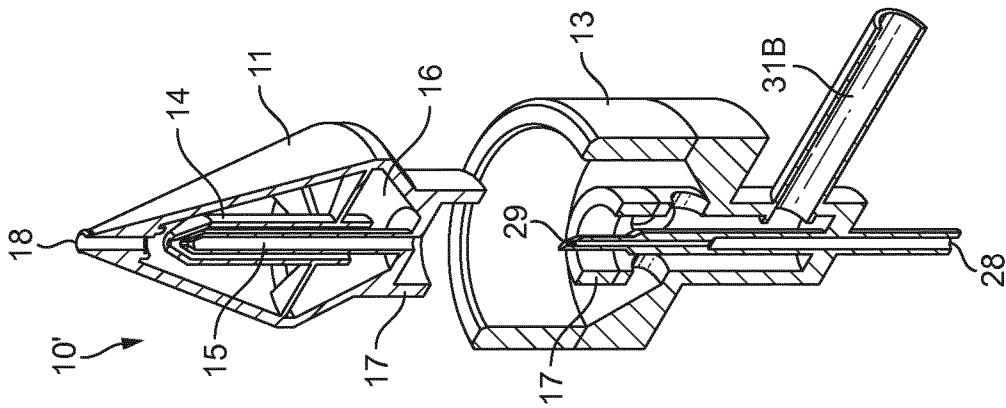


FIG. 2C

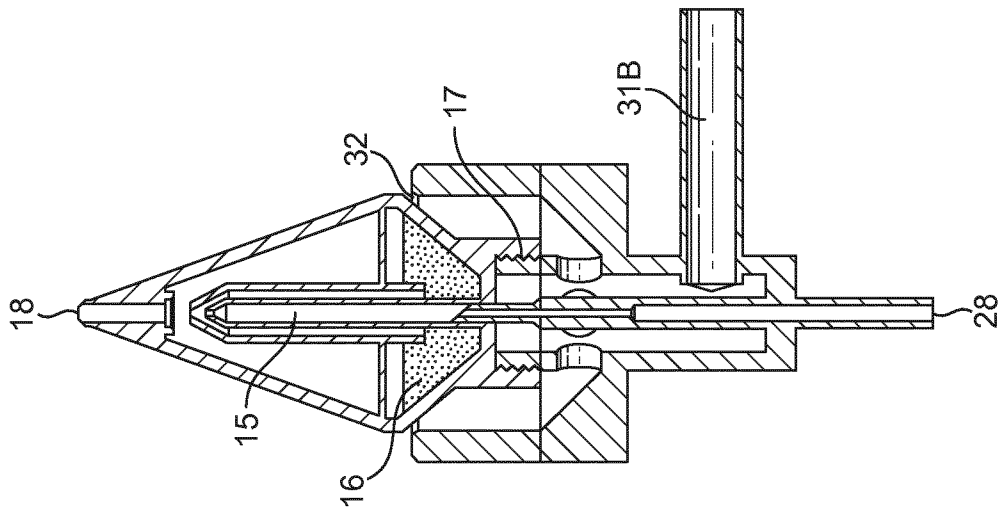


FIG. 2B

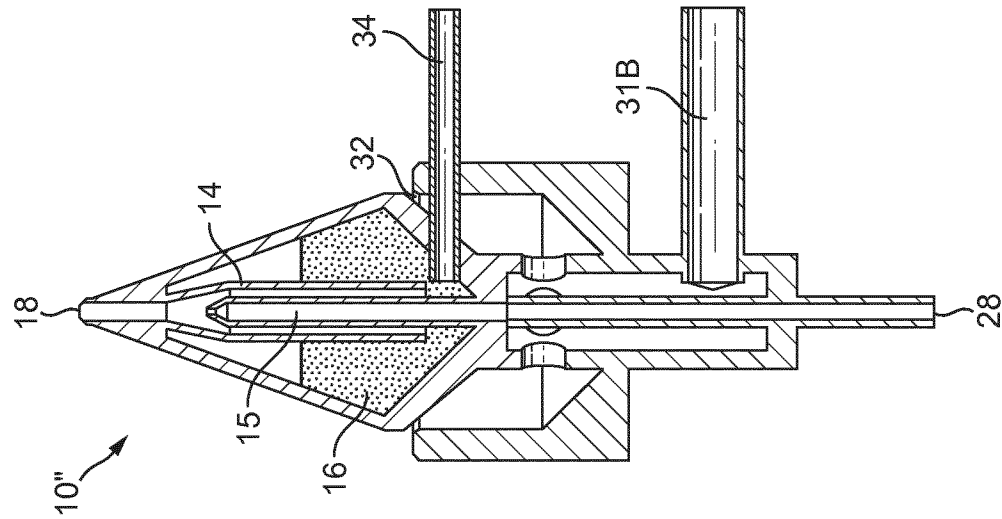


FIG. 3B

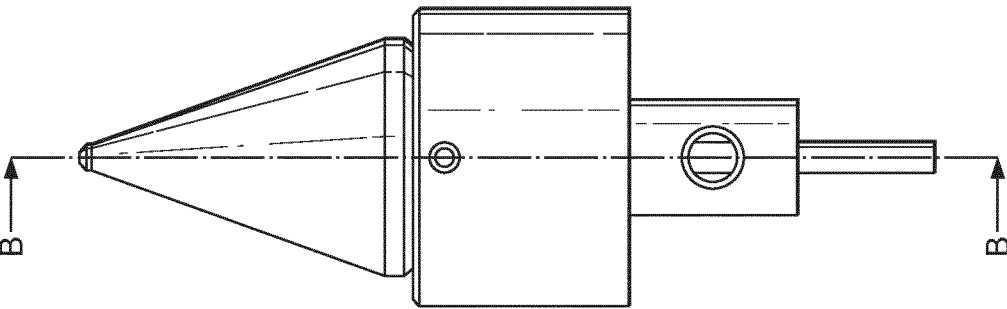


FIG. 3A

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/055320

A. CLASSIFICATION OF SUBJECT MATTER INV. A61M11/06 A61M16/10 A61M16/00 B05B11/00 B05B11/06 A61M16/12 A61M16/14 ADD. A61M11/00 A61M16/16		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) A61M B05B		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	paragraph [0001] - paragraph [0015] paragraph [0017] - paragraph [0033] figures 1-4	1-13

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Y	paragraph [0001] - paragraph [0011] paragraph [0014] - paragraph [0016] figure 1	1-13

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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search	Date of mailing of the international search report	
10 June 2016	23/06/2016	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Aguado, Miguel	

INTERNATIONAL SEARCH REPORT

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Information on patent family members

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